University of Waterloo
Department of Electrical and Computer Engineering
ECE 613: Image Processing and Visual Communications

Instructor
Prof. Zhou Wang, Email: *zhou.wang@uwaterloo.ca*; Web: *www.ece.uwaterloo.ca/~z70wang/*

Schedule
Follow announcements and instructions posted at LEARN: *https://learn.uwaterloo.ca*.

Course Description
This course covers the fundamental concepts and methods, as well as state-of-the-art theories and technologies, in the field of image processing and visual communications. Topics include fundamental digital image and video processing methods; image analysis and understanding; statistical and perceptual image modeling and processing; and compression, streaming, robustness, and scalability issues in visual communications.

Course Outline
1) Digital image and video processing
Intensity transformations for image enhancement; spatial domain linear filtering; frequency domain linear filtering; nonlinear image filtering; image sampling and interpolation; motion and digital video processing.

2) Image analysis and understanding
Edge detection; image segmentation; energy preserving and energy compaction; principle component analysis and independent component analysis; sparse representations; wavelet and multiresolution image analysis; non-linear image analysis.

3) Statistical and perceptual image modeling and processing
Spatial domain image statistics; Fourier domain statistical image models; wavelet domain statistical image models; Markov random field models; computational models of the human visual system; perceptual image quality assessment and processing; data-driven and learning-based image processing algorithms.

4) Visual communications: compression, quality, streaming, robustness and scalability
Video compression and standards; quality-of-service and quality-of-experience; adaptive video streaming; error resilient visual communications; multiple descriptive coding; scalable image and video coding and communications.

Textbooks and References
No required textbook. Electronic copies of lectures and study materials will be provided.
Additional references include
1) *Handbook of Image and Video Processing*, Bovik Ed., 2nd Edition, Academic Press, 2005.
2) *Digital Image Processing*, Gonzalez and Woods, 4th Edition, 2017.
3) Recent research papers found through search engines and public reservoirs, such as Google Scholar, ieeexplore.ieee.org, www.webofknowledge.com, arxiv.org, researchgate.net